Cancer Marker Database

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WAKNAGHAT

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CERTIFICATE

This is to certify that the work entitled, "**Cancer Marker Database**", submitted by "**Ankur Yadav(071514)**" in partial fulfillment for the award of degree of Bachelor of Technology in Bioinformatics of Jaypee University of Information Technology, Waknaghat has been carried out under our supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

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I would like to acknowledge http://abhyudayatech.com/ for providing me the facility to host the cancer marker database.

Ankur Yadav(071514)

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ABSTRACT

Cancer is a worldwide public health problem. Each year, 6 million people die from cancer and 8,1 million new cases are diagnosed. In twenty years from now, the cancer burden will exceed 50% due to the ageing of the population and their increasing exposure to risk factors. It is proven that the immune system plays a major role in recognizing and destroying tumor cells and it is possible that it may induce immunological responses, which may have therapeutic benefits against certain tumors.

Huge amount rigorous research is being carried out in order to predict the early onsets of cancers. Bioinformatics and computational biology can play a vital role in speeding up the various processes and to save time and money spend on such research activities. Speaking of bioinformatics and or computational biology, one cannot leave behind the importance of online databases, tools and servers. There are several databases available for use in the scientific community but all of them either lack in some information or other and hence not a single database could solve the various queries of the researcher. Here we present a comprehensive database that contains vital information on cancer and cancer markers. Cancer markers are of great importance in the sequential analysis and can help a great deal in the prediction of early onsets of cancers in humans. The database that we developed provides information on the possible cancer markers or motifs or domains or tags available for a particular type of cancer with the available citations for the particular entry in a single click on a single page. Literature information is available with direct link to PubMed. This could save a lot of time to the researchers and pace up their work.

CHAPTER – 1
INTRODUCTION

1.1 Cancer

1.1.1 About Cancer

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. Normally, cells grow and divide to form new cells as the body needs them. When cells grow old and die, new cells take their place. Sometimes this orderly process breaks down. New cells form when the body does not need them, or old cells do not die when they should. These extra cells can form a mass of tissue called a growth or tumor [1].

Tumors can be benign or malignant: Benign tumors are not cancer. Usually, doctors can remove them. In most cases, benign tumors do not come back after they are removed. Cells from benign tumors do not spread to tissues around them or to other parts of the body. Most important, benign tumors are rarely a threat to life. Malignant tumors are cancer. They are generally more serious and may be life threatening. Cancer cells can invade and damage nearby tissues and organs. Also, cancer cells can break away from a malignant tumor and enter the bloodstream or lymphatic system. That is how cancer cells spread from the original cancer (primary tumor) to form new tumors in other organs. The spread of cancer is called metastasis [1-2].

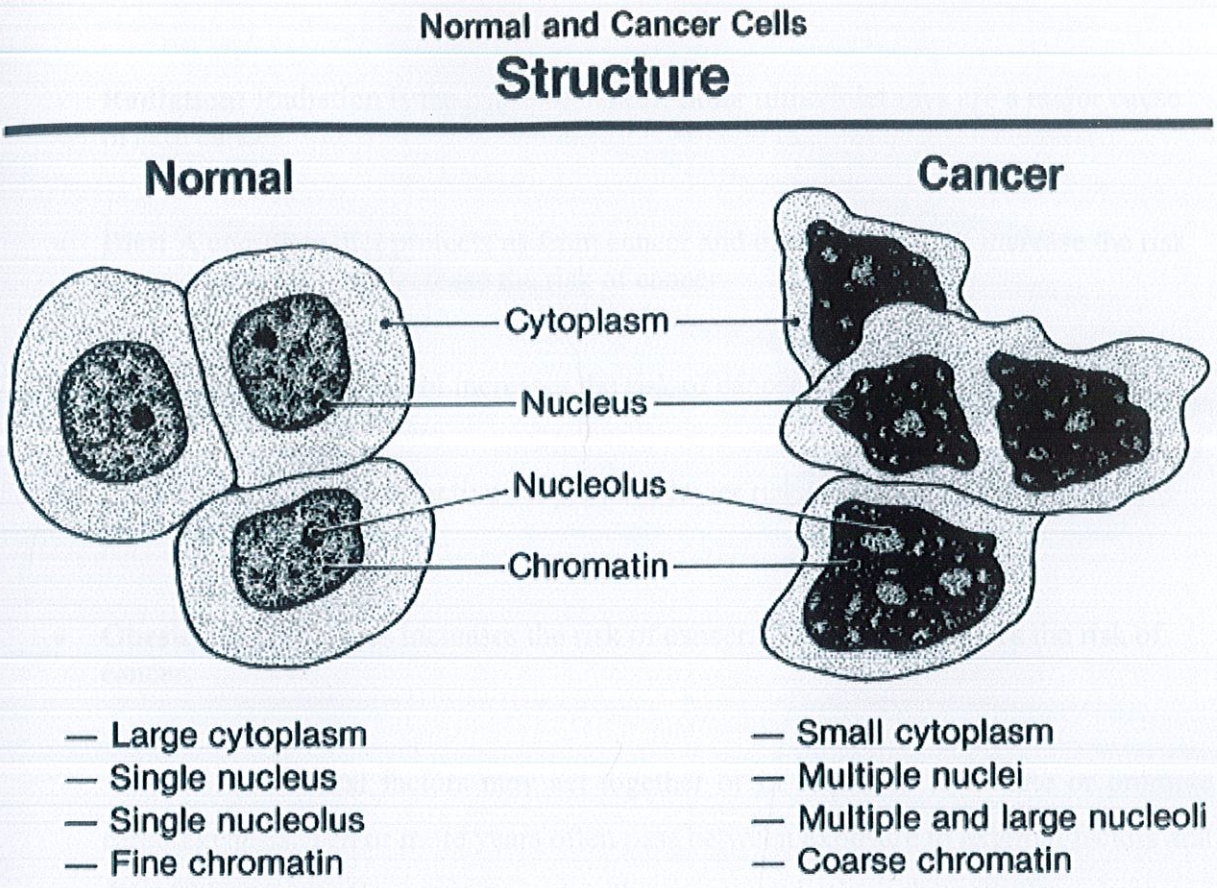


Fig.1. Difference between the structure of normal and cancer cells

Cancer is caused by:

- External factors (tobacco, infectious organisms, chemicals, and radiation) and

-Internal factors (inherited mutations, hormones, immune conditions, and mutations that occur from metabolism).

1.1.2 Risk Factors of Cancer:

Risk factors are associated with cancer. Some risk factors of cancer are as follows:

- **Cigarette Smoking:** A person who is cigarette smoker, at higher risk of lung cancer, oral cancer, bladder cancer, kidney cancer, pancreas cancer, stomach cancer etc. Cigarette smoking causes 30% of all deaths due to cancer in US.

- **Tobacco use:** A person who is using the tobacco is at higher risk of cancer.

- **Infections:** Infection is a cause of cancer. 18% infectious agents estimated of all cancer cases. Infections cases maximum found in developing country.

- **Radiation:** Radiation is the cause of cancer. Solar ultraviolet rays are a major cause of skin cancer.

- **Diet:** A complete diet protects us from cancer and other factors that increase the risk of cancer. Fruits also decrease the risk of cancer.

- **Alcohol:** Drinking alcohol increases the risk of cancer.

- **Physical activity:** More active people have lower risk of cancer. Physical activities protect us from cancer.

- **Obesity:** Body fatness increases the risk of cancer. Weight loss reduces the risk of cancer.

These causal factors may act together or in sequence to initiate or promote carcinogenesis. Ten or more years often pass between exposure to external factors and detectable cancer. Cancer is treated with surgery, radiation, chemotherapy, hormone therapy, biological therapy, and targeted therapy [3-5].

1.1.3 Signs and Symptoms

Cancer symptoms can be divided into three groups:

1. Local symptoms: are restricted to the site of the primary cancer. They can include lumps or swelling (tumor), hemorrhage (bleeding from the skin, mouth or anus),ulceration and pain. Although local pain commonly occurs in advanced cancer, the initial swelling is often painless.

2. Metastatic symptoms: are due to the spread of cancer to other locations in the body. They can include enlarged lymph nodes (which can be felt or sometimes seen under the skin), hepatomegaly (enlarged liver) or splenomegaly (enlarged spleen) which can be felt in the abdomen, pain or fracture of affected bones, and neurologicalsymptoms.

3. Systemic symptoms: occur due to distant effects of the cancer that are not related to direct or metastatic spread. Some of these effects can include weight loss (poor appetite and cachexia), fatigue, excessive sweating (especially night sweats), anemia (low red blood cell count) and other specific conditions termed paraneoplastic phenomena. These may be mediated by immunological or hormonal signals from the cancer cells [4].

None of these are diagnostic, as many of these symptoms commonly occur in patients who do not have cancer.

1.1.4 Causes

Cancers are primarily an environmental disease with 90-95% of cases attributed to environmental factors and 5-10% due to genetics. Environmental, as used by cancer researchers, means any cause that is not genetic. Common environmental factors that contribute to cancer death include: tobacco (25-30%), diet and obesity (30-35%),infections (15-20%), radiation (both ionizing and non

ionizing, up to 10%), stress, lack of physical activity, and environmental pollutants [5].

1.1.5 Diagnosis

Since prevention is one of the most important cancer-fighting tools, it is important that cancer be detected as early as possible before it spreads. There are numerous cancer detection and prevention tests that can be used to detect cancer. Cancer is suspected based on a person's symptoms, the results of a physical examination, and sometimes the results of screening tests. After cancer is diagnosed, it is staged. Staging is a way of describing how advanced the cancer has become, including such criteria as how big it is and whether it has spread to neighboring tissue or more distantly to lymph nodes or other organs.

Screening

Screening tests serve to detect the possibility that a cancer is present before symptoms occur. Screening tests usually are not definitive; results are confirmed or disproved with further examinations and tests. Diagnostic tests are performed once a doctor suspects that a person has cancer.

Although screening tests can help save lives, they can be costly and sometimes have psychologic or physical repercussions. Screening tests can produce false-positive results—results that suggest a cancer is present when it actually is not. False-positive results can create undue psychologic stress and can lead to other tests that are expensive and risky. Screening tests can also produce false-negative results—results that show no hint of a cancer that is actually present. False-negative results can lull people into a false sense of security. For these reasons, there are only a small number of screening tests that are considered reliable enough for doctors to use routinely.

Doctors determine whether a particular person is at special risk for cancer—because of age, sex, family history, previous history, or lifestyle—before they choose to perform screening tests.

In women, two of the most widely used screening tests are the Papanicolaou test to detect cervical cancer and mammography to detect breast cancer. Both screening tests have been successful in reducing the death rates from these cancers in certain age groups.

In men, prostate-specific antigen (PSA) levels in the blood may be used to screen for prostate cancer. PSA levels are high in men with prostate cancer, but levels also are elevated in men with noncancerous (benign) enlargement of the prostate. As such, the main drawback to its use as a screening test is the large number of false-positive results, which generally lead to more invasive tests [6].

Other diagnostic tests are:

Biopsy The surgical removal of a small piece of tissue to determine if the area is cancerous.

Cytology The examination of cells under a microscope looking for abnormalities.

CT Scan A CT (Computerized Tomography) scan creates cross-section images of the body, which may show cancer or metastases earlier and more accurately than other imaging methods.

Fine Needle Aspirate A procedure in which a needle is inserted under local anesthesia to obtain a sample for the evaluation of suspicious tissue.

Mammogram A diagnostic x-ray of the breast to screen for tumors. This technique uses low dose x-rays to produce an image of the breast. All suspicious lumps must be biopsied to determine whether or not they are cancerous.

Magnetic Resonance Imaging (MRI) A diagnostic procedure, which uses magnetic fields to produce images of the body.

Needle Biopsy A type of biopsy where a needle is used to withdraw small amounts of tissue or fluid for examination by a pathologist. This procedure is also called fine needle aspiration.

Positive Emission Tomography (PET) Positive Emission Tomography is a scanning method that gives information about the chemical function of the body, rather than the structure. A radioactive tracer is injected into a vein to provide a color-coded picture of the body.

PETscan

Cancer cells grow faster than other cells, so they use up energy faster, too. To measure how fast glucose (the body's fuel) is being used, a tracer (radioactive glucose) is injected into the body and scanned with a positron emission tomography (PET) machine. The PET machine detects how fast the glucose is being used. If it is

being used up faster in certain places, it may indicate the presence of a cancerous tumor [7].

Tumor Markers:

Tumor markers are substances secreted into the bloodstream by certain tumors. It was first thought that measuring levels of these markers would be an excellent way to screen asymptomatic people for cancer. However, tumor markers are often present to some extent in the blood of people who do not have cancer. Finding a tumor marker does not necessarily mean a person has cancer, and tumor markers have a very limited role in cancer screening.

CA-125 Tumor marker that may be elevated in cancers of the ovary, breast, and colon.

CA-19-9 A tumor marker that may be elevated in cancers of the colon and pancreas.

CA15-3 A tumor marker that may be elevated in breast cancer.

Staging:

When cancer is diagnosed, staging tests help determine how extensive the cancer is in terms of its location, size, growth into nearby structures, and spread to other parts of the body. People with cancer sometimes become impatient and anxious during staging tests, wishing for a prompt start of treatment. However, staging allows doctors to determine the most appropriate treatment as well as helping to determine prognosis.

Staging may use scans or other imaging tests, such as x-ray, CT, MRI, bone scintigraphy, or positron emission tomography (PET). The choice of staging test(s) depends on the type of cancer, as different cancers involve different parts of the body. CT scanning is used to detect cancer in many parts of the body, including the brain and lungs and parts of the abdomen, including the adrenal glands, lymph nodes, liver,

and spleen. MRI is of particular value in detecting cancers of the brain, bone, and spinal cord. Biopsies are often needed for staging and can sometimes be done together with the initial surgical treatment of a cancer.

In addition to imaging tests, doctors often obtain blood tests to see if the cancer has begun to affect the liver, bone, or kidneys

1.1.6 Types of Cancer

Cancer is a broad term used to encompass several malignant diseases. There are over 100 different types of cancer, affecting various parts of the body. Each type of cancer is unique with its own causes, symptoms, and methods of treatment. Like with all groups of disease, some types of cancer are more common than others [8-10].

Types of Cancer Classified by Body System

Cancer has the potential to affect every organ in the body. The cells within malignant tumors have the ability to invade neighboring tissues and organs, thus spreading the disease. It is also possible for cancerous cells to break free from the tumor and enter the bloodstream, in turn spreading the disease to other organs. This process of spreading is called metastasis.

When cancer has metastasized and has affected other areas of the body, the disease is still referred to the organ of origination. For instance, if cervical cancer spreads to the lungs, it is still called cervical cancer, not lung cancer.

Blood Cancer: The cells in the bone marrow that give rise to red blood cells, white blood cells, and platelets can sometimes become cancerous. These cancers are leukemia or lymphoma.

- Leukemia
- Lymphoma

Bone Cancer: Bone cancer is a relatively rare type of cancer that can affect both children and adults, but primarily affects children and teens. There are several types of bone cancer, but the most common type is:

- Osteosarcoma

Brain Cancer: Brain tumors can be malignant (cancerous) or benign (non-cancerous). They affect both children and adults. Malignant brain tumors don't often spread beyond the brain. However, other types of cancer have the ability to spread to the brain. Types of brain cancer include:

- Adult Brain Tumor
- Brain Stem Glioma, Childhood

Breast Cancer: Breast cancer is a common type of cancer that affects women and much less commonly men [10].

Digestive/Gastrointestinal Cancers: This is a broad category of cancer that affects everything from the esophagus to the anus. Each type is specific and has its own symptoms, causes, and treatments.

- Anal Cancer
- Colon Cancer
- Esophageal Cancer
- Gallbladder Cancer
- Liver Cancer
- Liver Cancer
- Pancreatic Cancer
- Rectal Cancer
- Small Intestine Cancer
- Stomach (Gastric) Cancer

Eye Cancer: Like other organs in the human body, the eyes are vulnerable to cancer as well. Eye cancer can affect both children and adults.

- Melanoma
- Retinoblastoma

Genitourinary Cancers: These types of cancer affect the male genitalia and urinary tract.

- Bladder Cancer
- Kidney (Renal Cell) Cancer
- Prostate Cancer

Gynecologic Cancers: This group of cancer types affect the organs of the female reproductive system. Specialized oncologists called gynecologic oncologists are recommended for treating gynecologic cancer.

- Cervical Cancer
- Ovarian Cancer
- Uterine Sarcoma
- Vaginal Cancer

Head and Neck Cancer: Most head and neck cancers affect moist mucosal surfaces of the head and neck, like the mouth, throat, and nose. Causes of head and neck cancer vary, but cigarette smoking plays a role.

- Laryngeal Cancer
- Lip and Oral Cancer
- Metastatic Squamous Neck Cancer
- Nasopharyngeal Cancer
- Salivary Gland Cancer

Respiratory Cancers: Cigarette smoking is the primary cause for cancer affecting the respiratory system. Exposure to asbestos is also a factor for Lung Cancer.

Skin Cancers: Non-melanoma skin cancer is the most common type of cancer among men and women. Exposure to the UV rays of the sun is the primary cause for non-melanoma skin cancer and also melanoma.

- Melanoma

1.2 Tumor Marker

1.2.1 What is Tumor Marker?

A tumor marker is a substance found in the blood, urine, or body tissues that can be elevated in cancer, among other tissue types. There are many different tumor markers, each indicative of a particular disease process, and they are used in oncology to help detect the presence of cancer. An elevated level of a tumor marker can indicate cancer; however, there can also be other causes of the elevation [11].

1.2.2 Description of Tumor Marker.

Tumor markers can be produced directly by the tumor or by non-tumor cells as a response to the presence of a tumor. Koepke outlines a hierarchy of clinical laboratory tests, from least to most informative. As used in oncology, they are as follows:

-Screening for common cancers on a population basis

Example: elevated prostate specific antigen suggests prostate cancer.

-Monitoring of cancer survivors after treatment

Example: elevated AFP in a child previously treated for teratoma suggests relapse with endodermal sinus tumor.

-Diagnosis of specific tumor types, particularly in certain brain tumors and other instances where biopsy is not feasible.

The term tumor antigen is sometimes interchangeably used for tumor marker.

1.2.3 Classification

Tumor markers can be classified in two groups: Cancer-specific markers and tissue-specific markers.

Cancer-specific markers

Cancer-specific markers are related to the presence of certain cancerous tissue. Because there is a large overlap between the many different tumor tissue types and the markers produced these markers might not be specific in making a diagnosis. They can, however, be useful in the follow-up of treated patients to describe progress of the disease or response to treatment. A few examples of these markers are CEA, CA19-9,CA125.

An example of a cancer-specific marker, CEA, or carcinoembryonic antigen, is a blood-borne protein, first noted to be produced by tumors of the gastrointestinal system. Further investigation showed that it was produced by the occasional lung and breast cancer case, meaning that an elevated level does not necessarily mean a bowel cancer. However, in a patient with a history of a treated bowel cancer, a rising CEA level can be an early sign of recurring bowel cancer. This usually occurs before the site of return can be identified on imaging or examination and so many oncologists question the wisdom of doing a blood test for CEA when the end result is bad news that alarms the patient. Nevertheless, a sequence of steady low CEA readings can provide much needed reassurance to the post-operative patient. Also, a rising sequence of CEA readings should alert the physician to the need for diagnostic tests such as PET scans [12-14].

Carbohydrate antigen 19-9 (CA 19-9)

Levels may be increased raised in people with cancers of the digestive tract, particularly pancreatic cancer.

CA125 has become a widely used tumor marker which is measured most often in women with cancers of the reproductive system including the uterus, fallopian tubes and ovaries. Other cancers that may cause abnormal CA125 levels include cancer of the pancreas, lungs, breast and colon. However, CA125/CA125-II can be elevated during menstruation, pregnancy or in individuals with ovarian cysts, pericarditis, hepatitis, cirrhosis of the liver or peritonitis, an infection of the lining of the abdomen, and even in 1-2% of healthy individuals. Once a cancer is diagnosed, CA125/CA125-II levels may prove to be an effective indicator of the effectiveness of cancer treatment. A declining CA125/CA125-II value may indicate a good response to treatment and a favorable prognosis. Persistently rising CA125/CA125-II levels may be associated with a growing tumor, presence of tumor on the peritoneum that lines the abdomen or a recurrence of a previously treated tumor [13-15].

Tissue-specific markers

Tissue-specific markers are related to specific tissues which have developed cancer. Generally speaking, these substances are not specifically related to the tumor, and may be present at elevated levels when no cancer is present. But unlike the previous group, elevated levels point to a specific tissue being at fault. Examples include PSA, beta-HCG - (Human chorionic gonadotropin), AFP - (Alpha-fetoprotein), AFP-L3 - (a lectin-reactive AFP) and Thyroglobulin. For example, if a man has an elevated PSA, a search for prostate cancer will be undertaken. If an individual has an elevated level of beta-HCG, AFP or AFP-L3%, a search for a testicular or liver cancer, respectively, will be made [16].

PSA (Prostate specific antigen) is produced by the normal prostate. It is a protein enzyme called a serine protease that usually acts as an anticoagulant to keep semen liquid. Only small amounts leak into the circulation in normal circumstances. Enlarged prostates leak more substantial amounts, and cancerous prostates also leak

substantial amounts. An accurate way to tell if an elevated PSA level results from cancer is to biopsy the prostate [11-14].

β-hCG: Elevated levels cannot prove the presence of a tumor, and low levels do not rule it out (an exception is in males who do not naturally produce β-hCG). Nevertheless, elevated βhCG levels fall after successful treatment (e.g. surgical intervention or chemotherapy), and a recurrence can often be detected by the finding of rising levels.

CA15-3: Elevated CA15-3, in conjunction with alkaline phosphates, was shown to increase chances of early recurrence in breast cancer [10].

1.2.4 What are Risk Markers?

Some people have a greater chance of developing certain types of cancer because of a change, known as a mutation or alteration, in specific genes. The presence of such a change is sometimes called a risk marker. Tests for risk markers can help the doctor to estimate a person's chance of developing a certain cancer. Risk markers can indicate that cancer is more likely to occur, whereas tumor markers can indicate the presence of cancer [2-4].

1.2.5 Objective: Brief Introduction about the project

The aim of this project is to develop a database for different Type of Cancer data and make it accessible via a web interface. The database should be maintainable by an administrator or different users with particular access admissions. A basic demand was an encryption of data pertaining to patient and user specific information. Different upload routines and input masks, which should be accessible via a web browser, have to be written in order to fill the database with the required data.

Several query algorithms have to be established with which the requested information should be aligned in an appropriate way by the MySQL software.

Finally the database's re-obtained Cancer Marker data should be brought into a systematic form. All the different experiment and patient information for each patient, all aligned in a matrix which can be clustered with particular algorithms. Some cluster results should be shown to demonstrate the functionality and necessity of this project. The major goals of this project will be separated into three main parts:

CHAPTER - 2
TOOLS AND TECHNIQUES

2.1 My SQL Server 5.0

MySQL is a relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases. It is written in C, C++, operating System involved is cross platform and is available in English.

The SQL phrase stands for Structured Query Language. The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation.

Free-software-open source projects that require a full-featured database management system often use MySQL [18-19].

2.2 MySQL Query Browser 1.1: Graphical Interface

MySQL Query Browser is a GUI query shell, intended to allow execution of SQL queries from a Web browser alike easy to use interface. It has such handy features as query history and bookmarking, tabular visualization of results, side-by-side result set comparison etc [19].

2.3 Advanced XML Converter 2.19

Advanced XML Converter helps to convert XML to other database and document formats: HTML, CSV, DBF, XLS and SQL. We have to upload the XML file and click CONVERT; the program delivers high-quality output in a new format as opted for. To deliver correct output, the program uses the hierarchical structure of the XML source to extract data. Then users can select the data that they want to see in the output. Advanced XML Converter is able to handle large XML files and convert more than one XML file in one go.

It converts XML files in three steps: The first step is to open XML source. Once selected, the program parses the XML file and group's tags by name and displays XML structure, as well as content for you to preview. This helps once to see structure and records of XML and select the fields you want to see in the output file after conversion. Step two is to select the conversion mode from several available. Each mode has its own settings to customize. The third step is when the program saves the output file [17].

We used the free trial version of XML Converter.

2.4 Active Perl (version 5)

Perl is a highly capable, feature-rich programming language with over 20 years of development. Perl 5 runs on over 100 platforms from portables to mainframes. Perl is suitable for both rapid prototyping and large scale development projects.

- **Easily extendible:** There are over 21,000 open source modules available from the Comprehensive Perl Archive Network (CPAN).
- **Object-oriented, procedural and functional:** It supports object-oriented, procedural and functional programming.
- **Text Manipulation:** Perl includes powerful tools for processing text that make it ideal for working with HTML, XML, and all other mark-up and natural languages.
- **Database Integration:** Perl's database integration interface (DBI) supports third-party databases including Oracle, Sybase, Postgres, MySQL and many others.

- **Open Source:** Perl is Open Source software, licensed under its Artistic License, or the GNU General Public License (GPL).
- **Unicode support:** Supports Unicode version 5
- **Embeddable:** The Perl interpreter can be embedded into other systems such as web servers and database servers [20].

2.5 HTML / CSS

HTML, which stands for Hyper Text Markup Language, is the predominant markup language for web pages. HTML is the basic building-blocks of web pages. Web browsers can also refer to Cascading Style Sheets (CSS) to define the appearance and layout of text and other material. CSS is designed primarily to enable the separation of document content (written in HTML or a similar markup language) from document presentation, including elements such as the layout, colors and fonts.

2.6 Adobe Dreamweaver

Adobe Dreamweaver (formerly Macromedia Dreamweaver) is a web development application originally created by Macromedia, and is now developed by Adobe Systems, which acquired Macromedia in 2005.

Dreamweaver is available for both Mac and Windows operating systems. Recent versions have incorporated support for web technologies such as CSS, JavaScript, and various server-side scripting languages and frameworks including ASP, ColdFusion, and PHP.

Features

Dreamweaver allows users to preview websites in locally installed web browsers. It provides transfer and synchronization features, the ability to find and replace lines of

text or code by search terms and regular expressions across the entire site, and a templating feature that allows single-source update of shared code and layout across entire sites without server-side includes or scripting. The behaviors panel also enables use of basic JavaScript without any coding knowledge, and integration with Adobe's Spry Ajax framework offers easy access to dynamically-generated content and interfaces.

Dreamweaver can use third-party "Extensions" to extend core functionality of the application, which any web developer can write (largely in HTML and JavaScript). Dreamweaver is supported by a large community of extension developers who make extensions available (both commercial and free) for most web development tasks from simple rollover effects to full-featured shopping carts.
Dreamweaver, like other HTML editors, edits files locally then uploads them to the remote web server using FTP, SFTP, or WebDAV. Dreamweaver CS4 now supports the Subversion (SVN) version control system

2.7 PHP

PHP is a general-purpose scripting language originally designed for web development to produce dynamic web pages. For this purpose, PHP code is embedded into the HTML source document and interpreted by a web server with a PHP processor module, which generates the web page document. It also has evolved to include a command-line interface capability and can be used in standalone graphical applications. PHP can be deployed on most web servers and as a standalone interpreter, on almost every operating system and platform free of charge. PHP is installed on more than 20 million websites and 1 million web servers.
PHP was originally created by Rasmus Lerdorf in 1995. The main implementation of PHP is now produced by The PHP Group and serves as the de facto standard for PHP as there is no formal specification. PHP is free software released under the PHP License; it is incompatible with the GNU General Public License (GPL) due to restrictions on the usage of the term PHP.

2.7 jQuery

jQuery is a cross-browser JavaScript library designed to simplify the client-side scripting of HTML. It was released in January 2006 at BarCamp NYC by John Resig. Used by over 43% of the 10,000 most visited websites, jQuery is the most popular JavaScript library in use today.

jQuery is free, open source software, dual-licensed under the MIT License and the GNU General Public License, Version 2. jQuery's syntax is designed to make it easier to navigate a document, select DOM elements, create animations, handle events, and develop Ajax applications. jQuery also provides capabilities for developers to create plug-in on top of the JavaScript library. Using these facilities, developers are able to create abstractions for low-level interaction and animation, advanced effects and high-level, theme-able widgets. This contributes to the creation of powerful and dynamic web pages.

Microsoft and Nokia have announced plans to bundle jQuery on their platforms, Microsoft adopting it initially within Visual Studio[6] for use within Microsoft's ASP.NET AJAX framework and ASP.NET MVC Framework while Nokia has integrated it into their Web Run-Time widget development platform. jQuery has also been used in Media Wiki since version 1.16

CHAPTER – 3

EnHouse: CANCER MARKER DATABASE DEVELOPMENT

3.1 Creating a Database

3.1.1 What is a Database?

A database is an organized collection of data for one or more purposes, usually in digital form. The data are typically organized to model relevant aspects of reality (for example, the availability of rooms in hotels), in a way that supports processes requiring this information (for example, finding a hotel with vacancies). The term "database" refers both to the way its users view it, and to the logical and physical materialization of its data, content, in files, computer memory, and computer data storage. This definition is very general, and is independent of the technology used. However, not every collection of data is a database; the term database implies that the data is managed to some level of quality (measured in terms of accuracy, availability, usability, and resilience) and this in turn often implies the use of a general-purpose Database management system (DBMS). A general-purpose DBMS is typically a complex software system that meets many usage requirements, and the databases that it maintains are often large and complex.

The term database is correctly applied to the data itself, and is different from the DBMS which is a software system that allows to store and change the data, as well as to retrieve information from it. The structure of a database is generally too complex to be handled without its DBMS, and any attempt to do otherwise is very likely to result in data corruption. DBMSs are packaged as computer software products: well-known products include the Oracle DBMS, Access and SQL Server from Microsoft, DB2 from IBM and the Open source DBMS MySQL.

3.1.2 Steps Followed:

Step 1: Data Collection

Firstly, I searched the most common types of cancer and chose 9 of them, which are:

Bladder Cancer
Brain Cancer
Breast cancer
Cervical cancer
Colorectal cancer
Esophageal cancer
Hodgkin's disease
Kidney cancer
Laryngeal Cancer

Then I gathered some general information and Tumor marker information. General information includes: Its brief introduction, How it is caused, Symptoms, Diagnosis, Treatments, Side effects of cancer treatment, Nutrition, follow-up care etc.
Tumor marker information includes: Accession Id ,length of the sequence, Protein sequence(in FASTA format),CDS etc. This information is collected From Wikipedia, NCBI etc.

Data Source

- **National Center for Biotechnology Information (NCBI)**: The National Center for Biotechnology Information (NCBI) is part of the United States National Library of Medicine (NLM), a branch of the National Institutes of Health. The NCBI is located in Bethesda, Maryland and was founded in 1988 through legislation sponsored by Senator Claude Pepper. The NCBI houses genome sequencing data in GenBank and an index of biomedical research articles in PubMed Central and PubMed, as well as other information relevant

to biotechnology. All these databases are available online through the Enter search engine.

- **Wikipedia**: Wikipedia is a free, web-based, collaborative, multilingual encyclopedia project supported by the non-profit Wikimedia Foundation. Its 18 million articles (over 3.6 million in English) have been written collaboratively by volunteers around the world, and almost all of its articles can be edited by anyone with access to the site. Wikipedia was launched in 2001 by Jimmy Wales and Larry Sanger and has become the largest and most popular general reference work on the Internet, ranking around seventh among all websites on Alexa and having 365 million readers.

Step 2: Created the Database using MYSQL:

Firstly I created a database named "Cancerdb" using Wamp server

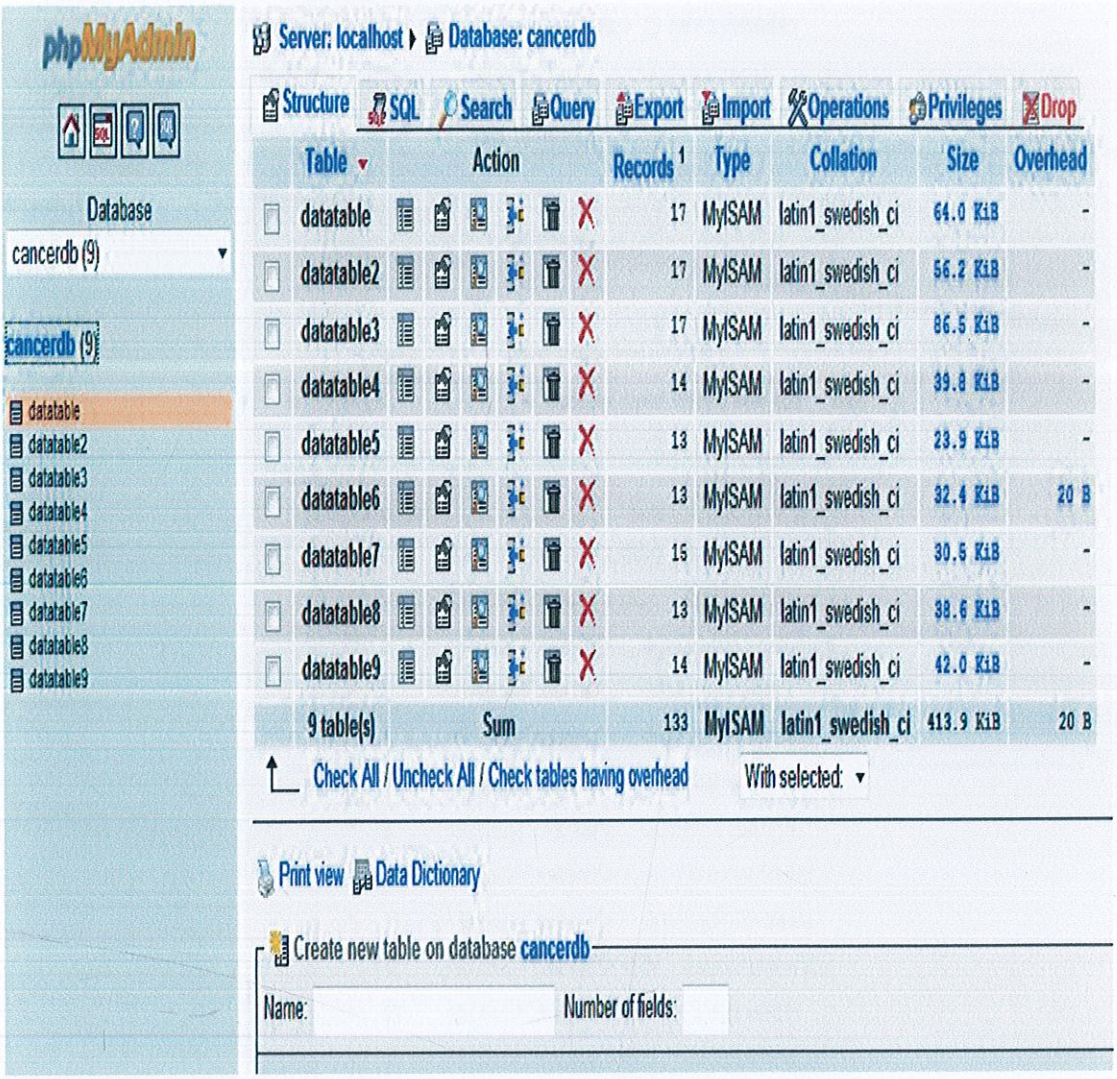


Fig.2. The above figure show collection of databases made in Wamp Server

Then I created 9 individual tables for each particular kind of cancer I have chosen, using Wamp Server.

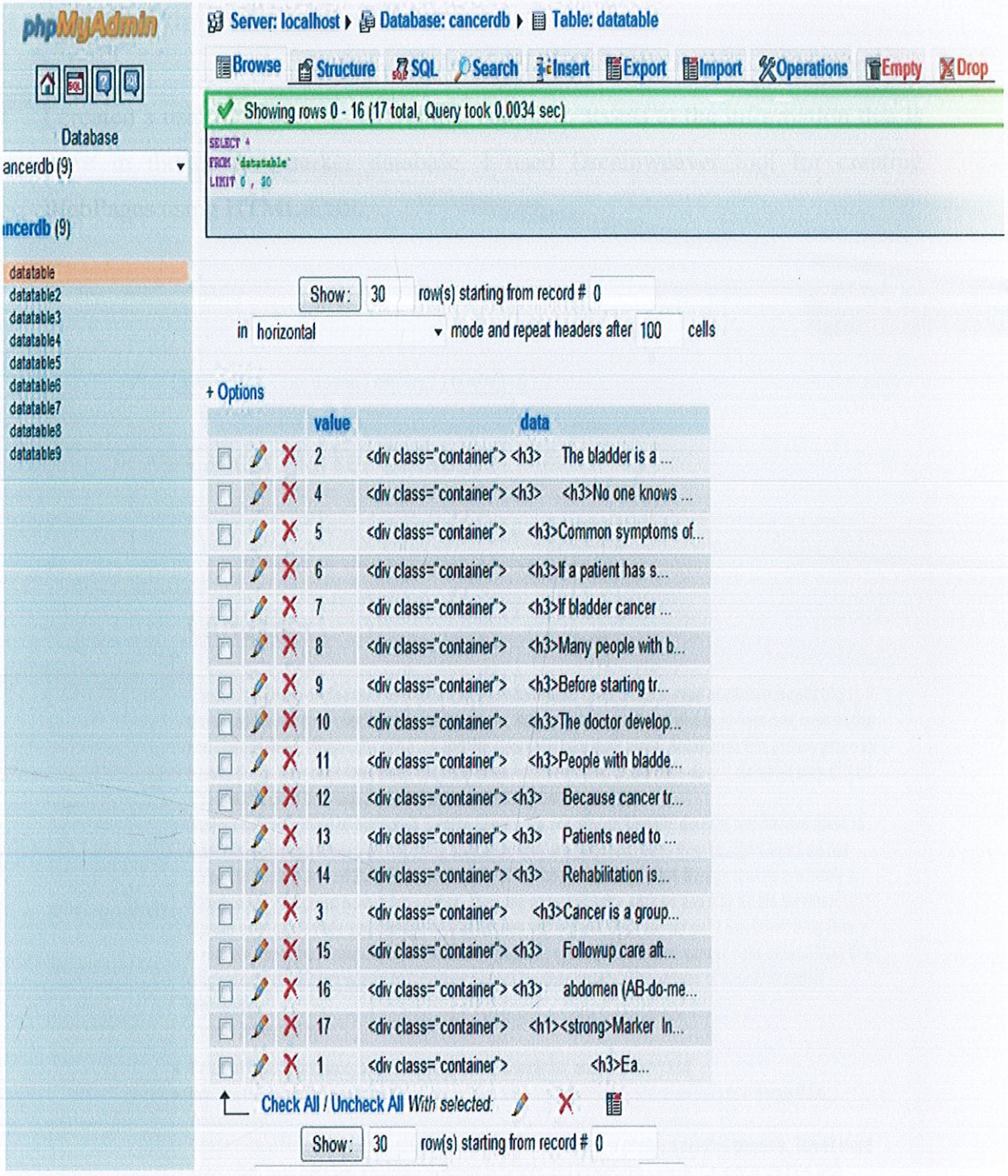


Fig.3. The above screen shot shows the contents of an individual database (Bladder Cancer).

3.2 Creating a User Interface

I created a user interface through which can have access to the information that is there in the cancer marker database. I used Dreamweaver tool for creating WebPages using HTML-CSS.

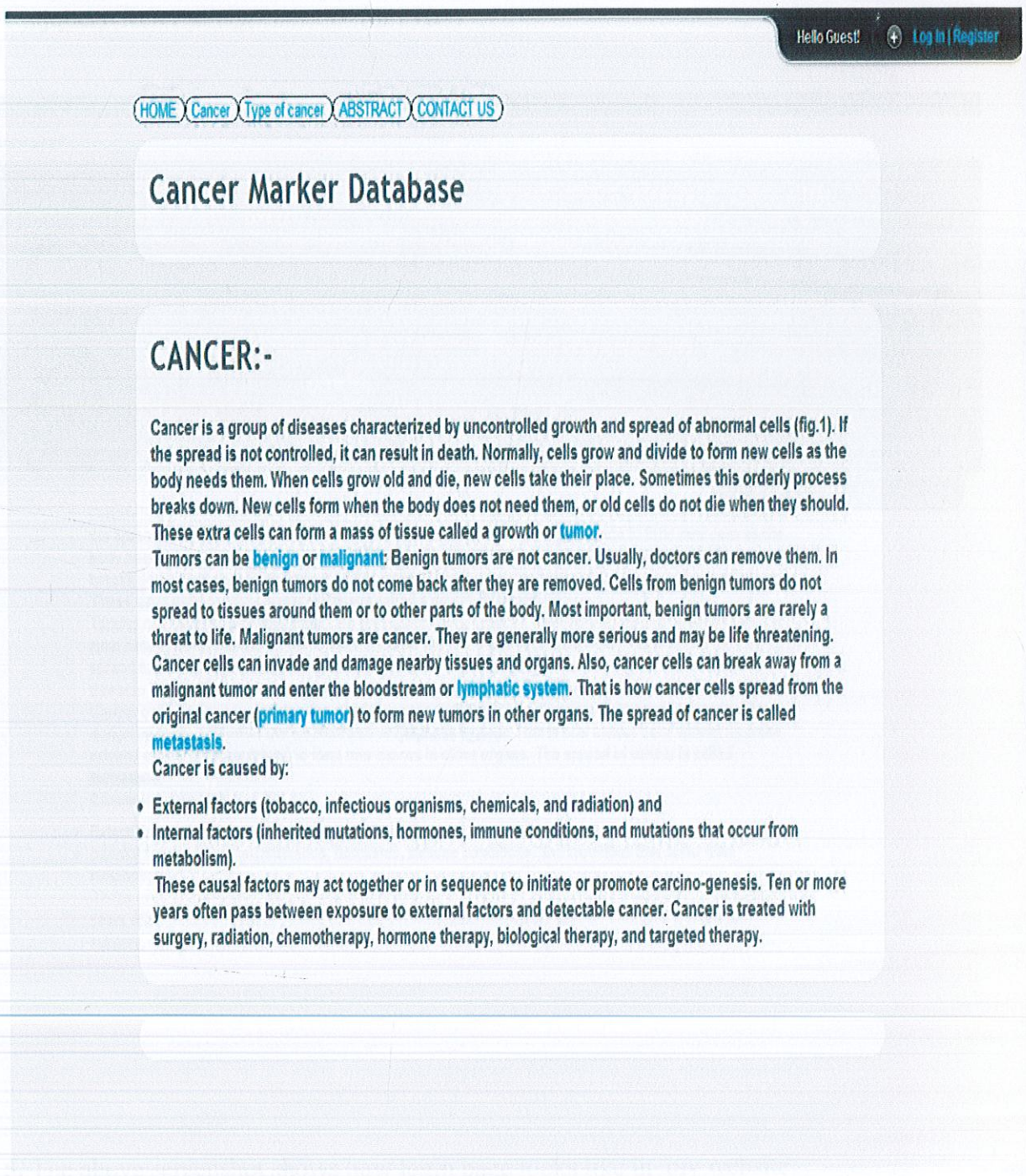


Fig.4. Graphical User Interface of my Website

3.2.1 Creation of homepage of website with the help of CSS

First of all background of the website was made using CSS (Refer to Appendix A for CSS code)

Secondly, the login page of the website was made with the help of jquery(Refer to Appendix B for PHP)

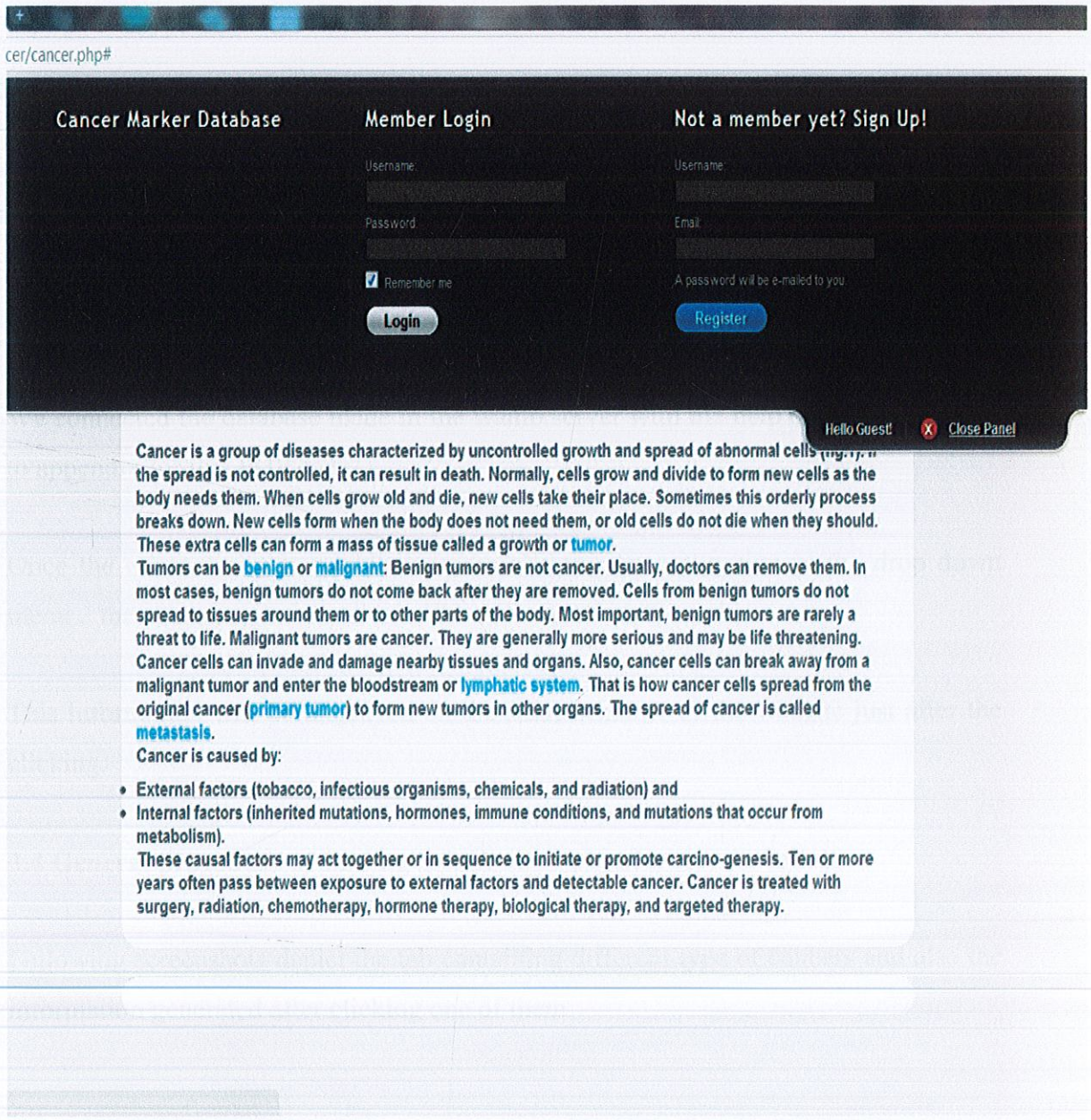


Fig. 5. The above screenshot shows how login page looks like in my website

Now we continue the preparation of homepage with the help of Dreamweaver

We developed text areas, menu and several other components of the website.(refer to appendix for the menu code.).the menu included cancer, type of cancer, abstract and contact us tabs. Similarly inside these links the WebPages were constructed in the same way.

Now in the menu developed on the homepage we can select any of the above option. Suppose we want to get information about a certain kind of a cancer. so we will select the option "type of cancer"

In this tab we have developed drop down menu for different type of cancer
The user will select any one option and the selected option will connect the database of cancer which has already been made in the wamp server

3.3 Connectivity

We connected the database made in the wamp server with the help of PHP code(refer to appendix for this PHP code).

Once the connectivity is established then clicking on any option in the drop down menu . the necessary information will be displayed on the website.

This information will be displayed on the same window of the website just after the clicking.

3.4 General procedure of finding information about a certain cancer

Following screenshots depict the tab containing different type of cancers and also the information generated after clicking one of them

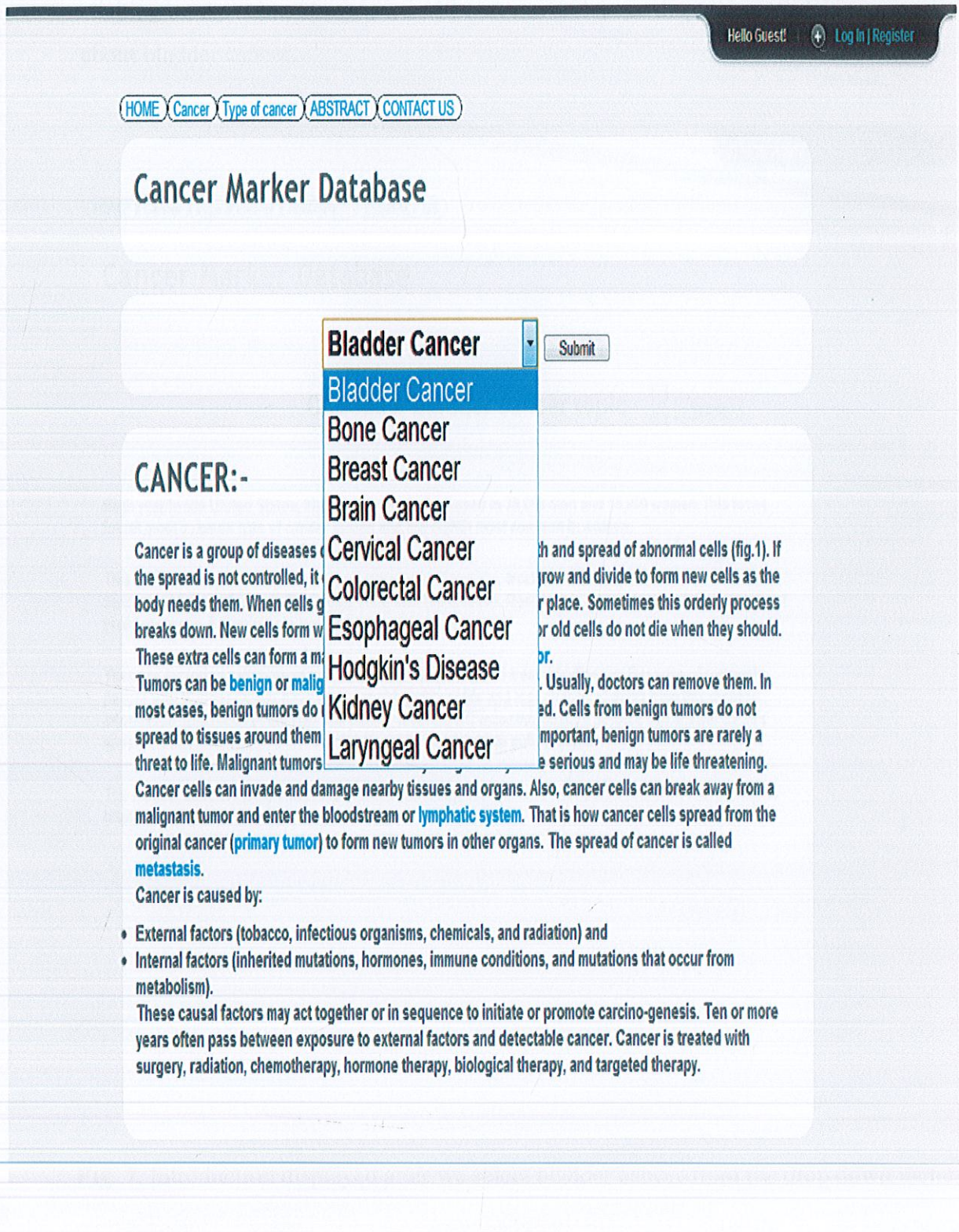


Fig. 6. Drop down menu showing different type of cancer

For example suppose we select a bladder cancer from the drop down menu.After clicking on the submit button we will move to web page displaying all the information about bladder cancer.

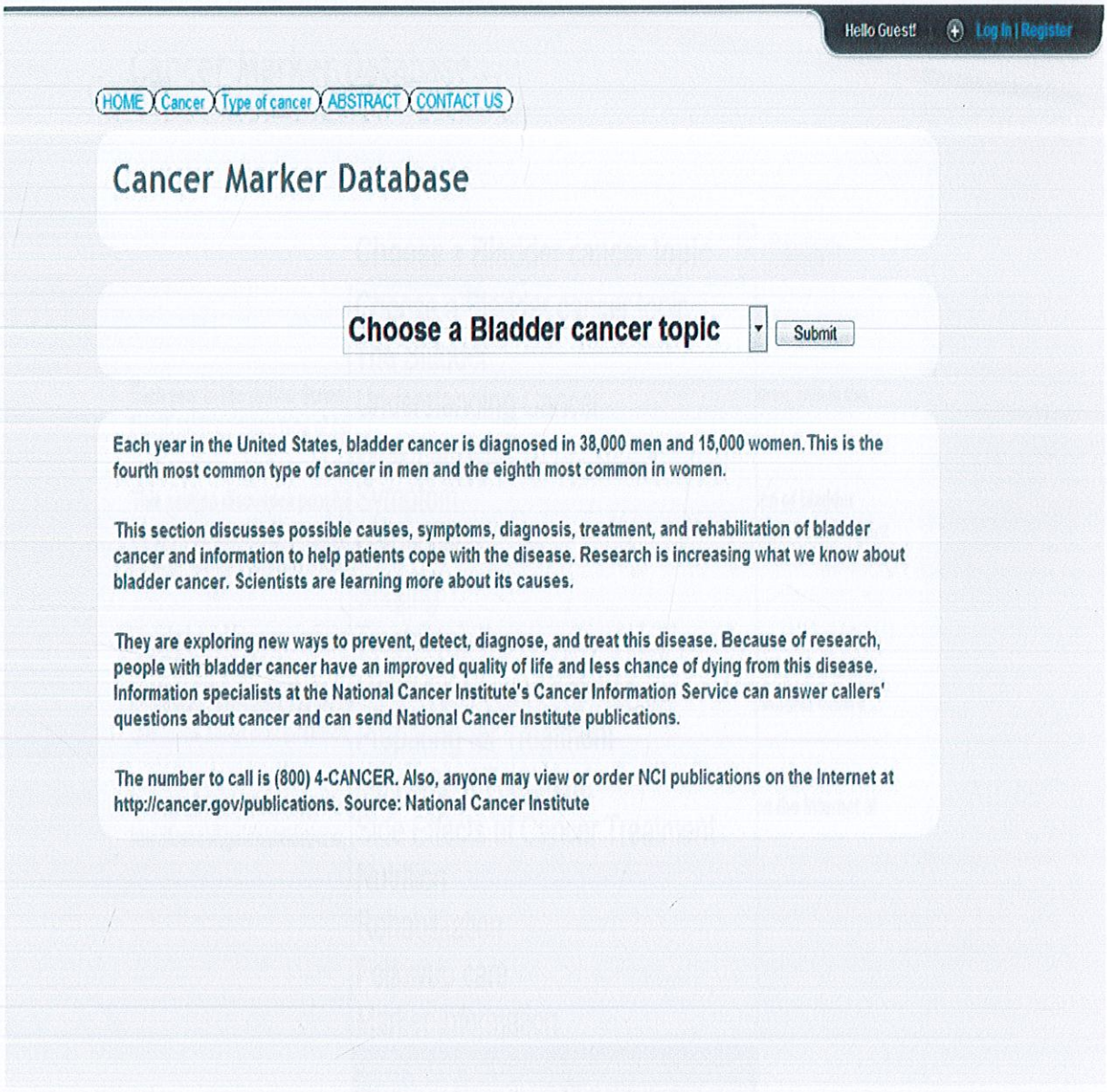


Fig. 7. Introduction displayed after we select bladder cancer from the drop down menu

Now another drop down menu will be displayed in which can select any topic concerning Bladder cancer. In this section following type of information can be found. All this information is gathered From my database made in Wamp server.

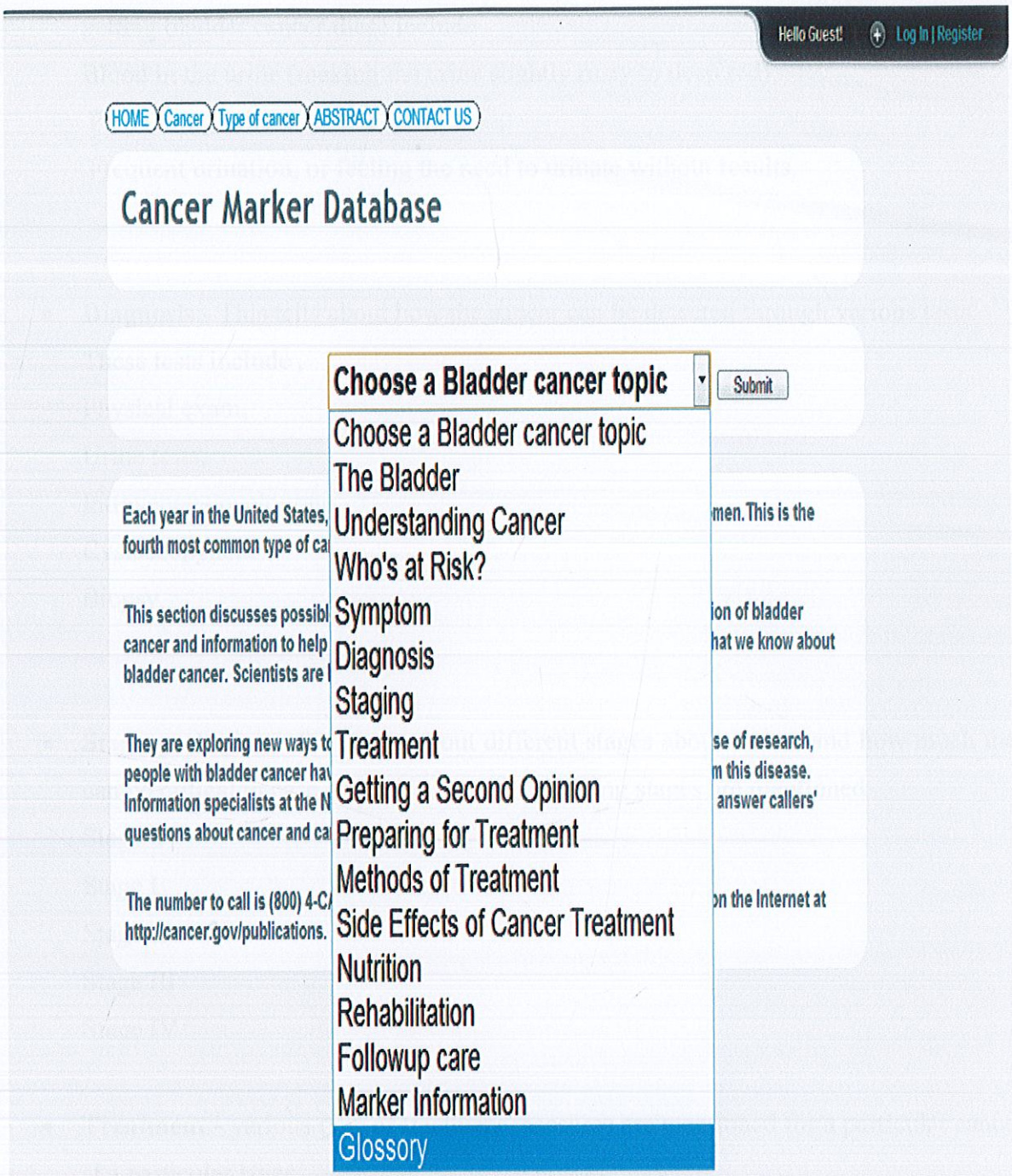


Fig.8. This screenshot shows different types of topics on which we can get information after selecting a certain kind of cancer For Example, as we select bladder cancer we get information about following types or sub-topics related to that particular cancer.

- **Symptom:-** This tells about the certain characteristics which a patient develop after getting bladder cancer.these include
  Blood in the urine (making the urine slightly rusty to deep red),
  Pain during urination, and
  Frequent urination, or feeling the need to urinate without results.

- **Diagnosis**:- This tells about how the cancer can be detected through various tests.
  These tests include ,
  Physical exam,
  Urine tests,
  Intravenous pyelogram,
  Cystoscopy,and
  Biopsy.

- **Staging**:- It give information about different stages about cancer and how much they can be critical.in case of bladder cancer following stages are mentioned
  Stage 0
  Stage I
  Stage II
  Stage III
  Stage IV

- **Treatment**:- various type of treatment measures are mentioned for a particular cancer at a particular stage

- **Side effects of treatment**:-This tells about how harmful the medicines given for the cure of certain cancer can prove to be.In case of Bladder cancer following side effect are mentioned in the data.
  Side Effects from Surgery,

Side Effects from Radiation Therapy,

Side Effects from Biological Therapy,and

Side Effects from Chemotherapy.

- **Nutrition:**-This tells about the diet chart of particular patient which he need to follow during his illness.It include all the necessary vitamin,protein,and other components needed in his food.

- **Rehabilitation**:-This tells about how the person who is suffering from the cancer can be brought to normal activity.

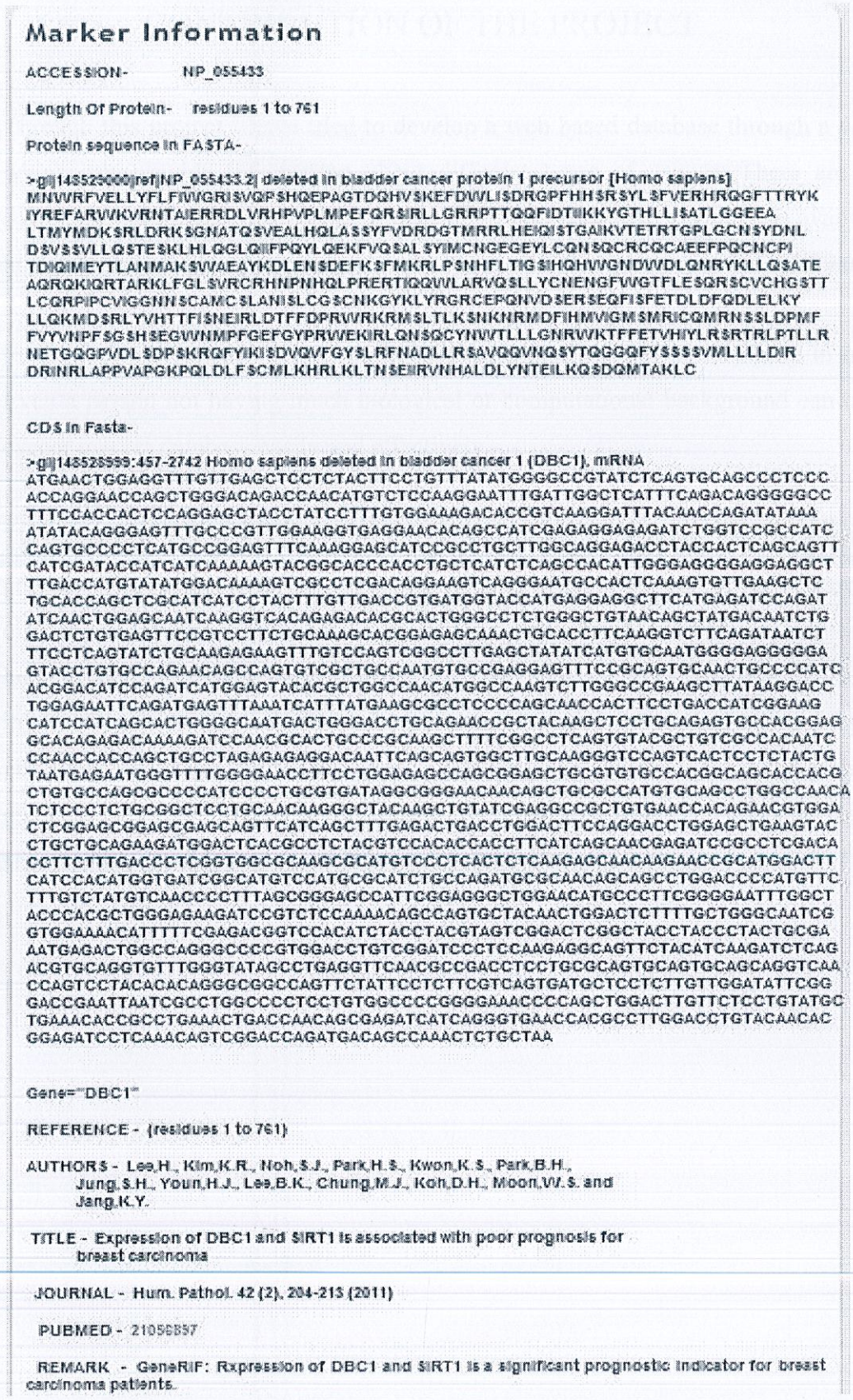
While choosing any topic about certain cancer marker information can be selected from the drop down menu display. The marker information is gathered mainly from the **NCBI** database

The **Marker Information** includes following things:

Accession No.
Length of protein
Protein sequences in FASTA
CDS in FASTA
Gene name
Literature information

Through this marker information one can easily find the details about the sequences present in cancer patients and can further study as well as make interpretations about what are the differences in the cancer sequence and the normal sequence.

Following screenshot shows how marker information is displayed on my website:



Marker Information

ACCESSION- NP_055433

Length Of Protein- residues 1 to 761

Protein sequence in FASTA-

>gi|148529000|ref|NP_055433.2| deleted in bladder cancer protein 1 precursor [Homo sapiens]
MNVVRFVELLYFLFIVVGRISVQPSHQEPAGTDQHVSKEFDVVLISDRGPFHHSRSYLSFVERHRQGFTTRYK
IYREFARVVKVRNTAIERRDLVRHPVPLMPEFQRSIRLLGRRPTTQQFIDTIIKKYGTHLLISATLGGEEA
LTMYMDKSRLDRKSGNATQSVEALHQLASSYFVDRDGTMRRLHEIQISTGAIKVTETRTGPLGCNSYDNL
DSVSSVLLQSTESKLHLGGLQIIFPQYLQEKFVQSALSYIMCNGEGEYLCQNSQCRCQCAEEFPQCNCPI
TDIQIMEYTLANMAKSVVAEAYKDLENSDEFKSFMKRLPSNHFLTIGSIHQHVVGNDVVDLQNRYKLLQSATE
AQRQKIQRTARKLFGLSVRCRHNPNHQLPRERTIQQVVLARVQSLLYCNENGFVVGTFLESQRSCVCHGSTT
LCQRPIPCVIGGNNSCAMCSLANISLCGSCNKGYKLYRGRCEPQNVDSERSEQFISFETDLDFQDLELKY
LLQKMDSRLYVHTTFISNEIRLDTFFDPRVVRKRMSLTLKSNKNRMDFIHMVIGMSMRICQMRNSSLDPMF
FVYVNPFSGSHSEGVVNMPFGEFGYPRVVEKIRLQNSQCYNVVTLLLGNRVVKTFFETVHIYLRSRTRLPTLLR
NETGQGPVDLSDPSKRQFYIKISDVQVFGYSLRFNADLLRSAVQQVNQSYTQGGQFYSSSSVMLLLLDIR
DRINRLAPPVAPGKPQLDLFSCMLKHRLKLTNSEIIRVNHALDLYNTEILKQSDQMTAKLC

CDS in Fasta-

>gi|148528999:457-2742 Homo sapiens deleted in bladder cancer 1 (DBC1), mRNA
ATGAACTGGAGGTTTGTTGAGCTCCTCTACTTCCTGTTTATATGGGGCCGTATCTCAGTGCAGCCCTCCC
ACCAGGAACCAGCTGGGACAGACCAACATGTCTCCAAGGAATTTGATTGGCTCATTTCAGACAGGGGGCC
TTTCCACCACTCCAGGAGCTACCTATCCTTTGTGGAAAGACACCGTCAAGGATTTACAACCAGATATAAA
ATATACAGGGAGTTTGCCCGTTGGAAGGTGAGGAACACAGCCATCGAGAGGAGAGATCTGGTCCGCCATC
CAGTGCCCCTCATGCCGGAGTTTCAAAGGAGCATCCGCCTGCTTGGCAGGAGACCTACCACTCAGCAGTT
CATCGATACCATCATCAAAAAGTACGGCACCCACCTGCTCATCTCAGCCACATTGGGAGGGGAGGAGGCT
TTGACCATGTATATGGACAAAAGTCGCCTCGACAGGAAGTCAGGGAATGCCACTCAAAGTGTTGAAGCTC
TGCACCAGCTCGCATCATCCTACTTTGTTGACCGTGATGGTACCATGAGGAGGCTTCATGAGATCCAGAT
ATCAACTGGAGCAATCAAGGTCACAGAGACACGCACTGGGCCTCTGGGCTGTAACAGCTATGACAATCTG
GACTCTGTGAGTTCCGTCCTTCTGCAAAGCACGGAGAGCAAACTGCACCTTCAAGGTCTTCAGATAATCT
TTCCTCAGTATCTGCAAGAGAAGTTTGTCCAGTCGGCCTTGAGCTATATCATGTGCAATGGGGAGGGGGA
GTACCTGTGCCAGAACAGCCAGTGTCGCTGCCAATGTGCCGAGGAGTTTCCGCAGTGCAACTGCCCCATC
ACGGACATCCAGATCATGGAGTACACGCTGGCCAACATGGCCAAGTCTTGGGCCGAAGCTTATAAGGACC
TGGAGAATTCAGATGAGTTTAAATCATTTATGAAGCGCCTCCCCAGCAACCACTTCCTGACCATCGGAAG
CATCCATCAGCACTGGGGCAATGACTGGGACCTGCAGAACCGCTACAAGCTCCTGCAGAGTGCCACGGAG
GCACAGAGACAAAAGATCCAACGCACTGCCCGCAAGCTTTTCGGCCTCAGTGTACGCTGTCGCCACAATC
CCAACCACCAGCTGCCTAGAGAGAGGACAATTCAGCAGTGGCTTGCAAGGGTCCAGTCACTCCTCTACTG
TAATGAGAATGGGTTTTGGGGAACCTTCCTGGAGAGCCAGCGGAGCTGCGTGTGCCACGGCAGCACCACG
CTGTGCCAGCGCCCCATCCCCTGCGTGATAGGCGGGAACAACAGCTGCGCCATGTGCAGCCTGGCCAACA
TCTCCCTCTGCGGCTCCTGCAACAAGGGCTACAAGCTGTATCGAGGCCGCTGTGAACCACAGAACGTGGA
CTCGGAGCGGAGCGAGCAGTTCATCAGCTTTGAGACTGACCTGGACTTCCAGGACCTGGAGCTGAAGTAC
CTGCTGCAGAAGATGGACTCACGCCTCTACGTCCACACCACCTTCATCAGCAACGAGATCCGCCTCGACA
CCTTCTTTGACCCTCGGTGGCGCAAGCGCATGTCCCTCACTCTCAAGAGCAACAAGAACCGCATGGACTT
CATCCACATGGTGATCGGCATGTCCATGCGCATCTGCCAGATGCGCAACAGCAGCCTGGACCCCATGTTC
TTTGTCTATGTCAACCCCTTTAGCGGGAGCCATTCGGAGGGCTGGAACATGCCCTTCGGGGAATTTGGCT
ACCCACGCTGGGAGAAGATCCGTCTCCAAAACAGCCAGTGCTACAACTGGACTCTTTTGCTGGGCAATCG
GTGGAAAACATTTTTCGAGACGGTCCACATCTACCTACGTAGTCGGACTCGGCTACCTACCCTACTGCGA
AATGAGACTGGCCAGGGCCCCGTGGACCTGTCGGATCCCTCCAAGAGGCAGTTCTACATCAAGATCTCAG
ACGTGCAGGTGTTTGGGTATAGCCTGAGGTTCAACGCCGACCTCCTGCGCAGTGCAGTGCAGCAGGTCAA
CCAGTCCTACACACAGGGCGGCCAGTTCTATTCCTCTTCGTCAGTGATGCTCCTCTTGTTGGATATTCGG
GACCGAATTAATCGCCTGGCCCCTCCTGTGGCCCCGGGGAAACCCCAGCTGGACTTGTTCTCCTGTATGC
TGAAACACCGCCTGAAACTGACCAACAGCGAGATCATCAGGGTGAACCACGCCTTGGACCTGTACAACAC
GGAGATCCTCAAACAGTCGGACCAGATGACAGCCAAACTCTGCTAA

Gene="DBC1"

REFERENCE - (residues 1 to 761)

AUTHORS - Lee,H., Kim,K.R., Noh,S.J., Park,H.S., Kwon,K.S., Park,B.H., Jung,S.H., Youn,H.J., Lee,B.K., Chung,M.J., Koh,D.H., Moon,W.S. and Jang,K.Y.

TITLE - Expression of DBC1 and SIRT1 is associated with poor prognosis for breast carcinoma

JOURNAL - Hum. Pathol. 42 (2), 204-213 (2011)

PUBMED - 21056857

REMARK - GeneRIF: Expression of DBC1 and SIRT1 is a significant prognostic indicator for breast carcinoma patients.

Fig. 9. Marker Information about Bladder Cancer

CONTRIBUTION OF THE PROJECT

Through this project I have tried to develop a web based database through a website which can provide information about different types of cancer. There are many advantages of developing such a website for cancer database. Database is available at http://abhyudayatech.com/cmdb.

First of all the website developed is quite user friendly and is very easy to handle. Even a person not having much biological or computational background can use the cancer marker database easily and effectively.

This database developed provides all the necessary information needed for cancer patients. The marker information on the website is quite helpful for the researcher to distinguish between normal sequences and mutated sequences of cancer and thus can help to find necessary and effective cure for cancer. With the help of literature information scientist's can easily fetch the required information regarding the papers published related to particular types of cancer. Also the security of the website is maintained through login system so that only reliable persons can access the database and can also provide some new information related to certain kind of cancers.

CONCLUSION

We have developed a database that is capable to allow the users to search through the available data on cancerous information regarding various biological, biochemical and biomedical aspects. It not only provides the above mentioned information but also provides the relative literature and cited documents for reference through PubMed. This database is in its beta form and will be made available publically once the first release is complete. Prediction or identification of early onset of cancer is very important in order to fight this disease efficiently. In this post genomic era, when anyone can have their genome sequenced, they can also have their genomes analyzed. Doing so, by the use of powerful tools of genomics and evolutionary genetics one can identify the plausible early onset of cancer in any genomic sequence. To do so, one would need to analyze the sequence and study the available cancerous motifs or motifs that could turn into cancerous. Hence we need to refer to databases that could provide such information. Though there are several databases available today but every database lack something or other. For this purpose and to add the consistency we are presenting here a database that provides a handful of information on such cancers. This database will help students, researchers and medical professional as all the information related to one specified type of cancer, can be obtained by a single query. Database is available for academic and research use at http://abhyudayatech.com/cmdb.

APPENDIX A

CSS

```
<style type="text/css">

#cssdropdown, #cssdropdown ul {
padding: 0;
margin: 0;
list-style: none;
}

#cssdropdown li {
float: left;
position: relative;
}

.mainitems{
border: 1px solid black;
background-color: #FFFFFF;
-moz-border-radius:20px;
        -khtml-border-radius: 20px;
        -webkit-border-radius: 20px;
        border-radius:20px;
}

.mainitems a{
margin-left: 6px;
margin-right: 8px;
text-decoration: none;
}
```

```
.subuls{
display: none;
width: 10em;
position: absolute;
top: 1.2em;
left: 0;
background-color: lightyellow;
border: 1px solid black;
}

.subuls li{
width: 100%;
}

.subuls li a{
text-decoration: underline;
}

#cssdropdown li>ul { /* to override top and left in browsers other than IE, which will
position to the top right of the containing li, rather than bottom left */
top: auto;
left: auto;
}
#cssdropdown li:hover ul, li.over ul { /* lists nested under hovered list items */
display: block;
}
#restofcontent { /*wrap rest of content of the page inside this div*/
clear: left;
}

</style>
```

APPENDIX B

PHP

```
<?php
error_reporting(E_ALL ^ E_NOTICE);
define('INCLUDE_CHECK',true);

require 'connect.php';
require 'functions.php';
// Those two files can be included only if INCLUDE_CHECK is defined


session_name('tzLogin');
// Starting the session

session_set_cookie_params(2*7*24*60*60);
// Making the cookie live for 2 weeks

session_start();

if($_SESSION['id'] && !isset($_COOKIE['tzRemember']) &&
!$_SESSION['rememberMe'])
{
// If you are logged in, but you don't have the tzRemember cookie (browser restart)
// and you have not checked the rememberMe checkbox:

$_SESSION = array();
session_destroy();

// Destroy the session
}
```

```
if(isset($_GET['logoff']))
{
$_SESSION = array();
session_destroy();

header("Location: demo.php");
exit;
}

if($_POST['submit']=='Login')
{
// Checking whether the Login form has been submitted

$err = array();
// Will hold our errors


if(!$_POST['username'] || !$_POST['password'])
$err[] = 'All the fields must be filled in!';


if(!count($err))
{
$_POST['username'] = mysql_real_escape_string($_POST['username']);
$_POST['password'] = mysql_real_escape_string($_POST['password']);
$_POST['rememberMe'] = (int)$_POST['rememberMe'];


// Escaping all input data


$row = mysql_fetch_assoc(mysql_query("SELECT id,usr FROM tz_members
WHERE usr='{$_POST['username']}' AND pass='".md5($_POST['password'])."'"));
```

```
if($row['usr'])
{
// If everything is OK login

$_SESSION['usr']=$row['usr'];
$_SESSION['id'] = $row['id'];
$_SESSION['rememberMe'] = $_POST['rememberMe'];

// Store some data in the session


setcookie('tzRemember',$_POST['rememberMe']);
}
else $err[]='Wrong username and/or password!';
}


if($err)
$_SESSION['msg']['login-err'] = implode('<br />',$err);
// Save the error messages in the session

header("Location: demo.php");
exit;
}
else if($_POST['submit']=='Register')
{
// If the Register form has been submitted


$err = array();

if(strlen($_POST['username'])<4 || strlen($_POST['username'])>32)
{
$err[]='Your username must be between 3 and 32 characters!';
```

```
}

if(preg_match('/[^a-z0-9\-\_\.]+/i',$_POST['username']))
{
$err[]='Your username contains invalid characters!';
}

if(!checkEmail($_POST['email']))
{
$err[]='Your email is not valid!';
}

if(!count($err))
{
// If there are no errors

$pass =
substr(md5($_SERVER['REMOTE_ADDR'].microtime().rand(1,100000)),0,6);
// Generate a random password

$_POST['email'] = mysql_real_escape_string($_POST['email']);
$_POST['username'] = mysql_real_escape_string($_POST['username']);
// Escape the input data


mysql_query("INSERT INTO tz_members(usr,pass,email,regIP,dt)
VALUES(

'".$_POST['username']."',
'".md5($pass)."',
'".$_POST['email']."',
'".$_SERVER['REMOTE_ADDR']."',
NOW()
```

```
)");

if(mysql_affected_rows($link)==1)
{
send_mail(      'cancer database',
$_POST['email'],
'Registration System  - Your New Password',
'Your password is: '.$pass);


$_SESSION['msg']['reg-success']='We sent you an email with your new password!';
}
else $err[]='This username is already taken!';
}


if(count($err))
{
$_SESSION['msg']['reg-err'] = implode('<br />',$err);
}

header("Location: demo.php");
exit;
}


$script = '';

if($_SESSION['msg'])
{
// The script below shows the sliding panel on page load

$script = '
<script type="text/javascript">
```

```
$(function(){

$("div#panel").show();
$("#toggle a").toggle();
});

</script>';

}
?>
```

APPENDIX C

HTML/CSS

```
<div class="tab">
<ul class="login">
<li class="left"> </li>

<li>Hello <?php echo $_SESSION['usr'] ? $_SESSION['usr'] : 'Guest';?>!</li>
<li class="sep">|</li>
 <li id="toggle">

 <a id="open" class="open" href="#"><?php echo $_SESSION['id']?'Open
Panel':'Log In | Register';?></a>

 <a id="close" style="display: none;" class="close" href="#">Close Panel</a>

 </li>
 <li class="right"> </li>
 </ul>

 </div> <!-- / top -->

</div> <!--panel -->

<div class="pageContent">

  <div id="main">
   <div>

<ul id="cssdropdown">
```

```
<li class="mainitems">
<a href="cancer.php">HOME</a></li>
<li class="mainitems">
<a href="cancer.php">Cancer</a></li>
<li class="mainitems">
<a href="Cancertype.php">Type of cancer</a></li>



<li class="mainitems">
<a href="abstract.php">ABSTRACT</a>
</li>

<li class="mainitems">

<a href="contactus.php">CONTACT US</a>
</li>
</ul>
</div>
```

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BRIEF BIO-DATA OF THE STUDENT

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Ankur Yadav is going to complete his degree in Bachelor of Technology in Bioinformatics from Jaypee University of Information Technology, Waknaghat, Solan, H.P., INDIA in June 2011. His technical interests include: Web Designing, Database development and management.

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